

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions, and listings, of claims in the application.

1. (Currently Amended) A heat exchanger including plate fins and tubes comprising:

a plurality of fins stacked at respective intervals; and
a plurality of heat exchanger tubes penetrating each of said fins in a fin-stacking direction, said heat exchanger exchanging heat between a first fluid flowing inside said heat exchanger tubes and a second fluid flowing outside said heat exchanger tubes, wherein

each of said fins includes a main body that is substantially planar and a plurality of cut-raised portions extending from said main body, located on both of upstream and downstream sides of said fins with respect to a direction of flow of the second fluid flowing outside said heat exchanger tubes,

~~the cut raised portions on the upstream side and the cut raised portions on the downstream side are symmetrically disposed with respect to a center line connecting respective centers of said heat exchanger tubes, the center line being aligned in a column direction that extends parallel to an edge of each of said fins,~~

each of said cut-raised portions corresponds to a respective heat exchanger tube and includes first and second opposed side ends connected to the main body of said fin, the first side end being nearer to the corresponding heat exchanger tube and being longer than the first side end,

said cut-raised portions are disposed only within one of a plurality of regions of said fin, each of said regions being centered about a respective heat exchanger tube and satisfying

$$W_s = (1 - \phi) D_p + \phi D$$

$$1.0 \geq \phi > 0.5,$$

Ws is the width of each of said regions corresponding to respective heat exchanger tubes in ~~the a~~ column direction that extends parallel to an edge of each of said fins,

D is the outer diameter of each of said heat exchanger tubes,

D_p is the pitch of said heat exchanger tubes in the column direction,

no cut-raised portion is present in an area of said fin centered, in the column direction, between adjacent pairs of said heat exchanger tubes and having a width W_f, in the column direction, satisfying

$$W_f = \varphi (D_p - D), \text{ and}$$

$$W_f + W_s = D_p.$$

2. (Previously Presented) The heat exchanger according to claim 1, wherein said cut-raised portions corresponding to each of said heat exchanger tubes are disposed only in a region of said fins which falls within 130 degrees of a central angle of the corresponding heat exchanger tube, toward upstream and downstream directions of the second fluid.

3. (Currently Amended) The heat exchanger according to claim 1, wherein each of said cut-raised portions has two opposite edges disconnected from ~~a~~ said main body of said fin, at least one of the corresponding edges extending obliquely relative to the column direction.

4. (Currently Amended) The heat exchanger according to claim 1, wherein each of said cut-raised portions has two opposite edges disconnected from ~~a~~ said main body of the corresponding fin, at least one of said edges extending in a radial direction of the corresponding heat exchanger tube.

5. (Currently Amended) The heat exchanger according to claim 1, wherein each of said including a further cut-raised portions has portion having two opposed

side ends connected to ~~a~~ said main body of the corresponding fin, wherein at least one of said side ends ~~extending of said~~ further cut-raised portion extends in a direction perpendicular to the column direction.

6. (Currently Amended) The heat exchanger according to claim 1, including at least two of said cut-raised portions for each of said heat exchanger tubes, said cut-raised portions being disposed symmetrically with respect to an axis ~~passing that~~ passes through the center of ~~said~~ the corresponding heat exchanger tube and ~~extending~~ that extends in a direction perpendicular to the column direction.

7. (Previously Presented) The heat exchanger according to claim 1, wherein each of said cut-raised portions has a shape raised alternately in a longitudinal direction of said heat exchanger tubes.

8. (Previously Presented) The heat exchanger according to claim 1, wherein each of said fins includes a convex protrusion continuously extending in the column direction.

9. (Currently Amended) The heat exchanger according to claim 1, wherein each of said cut-raised portions is cut and raised from ~~a~~ said main body of said fin to form a bridge shape which has a leg segment connected to said main body, and a beam segment spaced apart from said main body.

10. (New) The heat exchanger according to claim 1, wherein each of said cut-raised portions includes first and second opposed edges not directly connected to said main body of said fin, the first edge being nearer to an upstream side of flow of the second fluid flowing across said fin and being longer than the second edge.